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APPLICATION NUMBER: *60/110,643*
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PCT APPLICATION NUMBER: *PCT/US99/26562*

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12/01/98 U.S. PTO

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
ROGER JAMES	SMITH	12739 Vista Drive N.E. Bainbridge, Washington 98110

☐ Additional inventors are being named on the ___ separately numbered sheets attached hereto

TITLE OF THE INVENTION (280 characters max)

A PULSED POLARIMETER

CORRESPONDENCE ADDRESS

Direct all correspondence to:

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OR

☐ Firm or Individual Name	UNIVERSITY OF WASHINGTON				
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City	SEATTLE	State	WASH.	ZIP	98195-2250
Country	U.S.A	Telephone	206-543-4140	Fax	206-543-4719

ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification Number of Pages 3 ☒ Small Entity Statement

☒ Drawing(s) Number of Sheets 2 ☒ Other (specify) Duplicate of Specification and drawings

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)

☒ A check or money order is enclosed to cover the filing fees

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____

Respectfully submitted,

SIGNATURE Roger J Smith

Date 11/23/98

TYPED or PRINTED NAME ROGER J. SMITH

REGISTRATION NO. (if appropriate) ____

TELEPHONE 206-543-4140

Docket Number: ____

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60110643.120198

PROVISIONAL APPLICATION COVER SHEET
Additional Page

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INVENTOR(S)/APPLICANT(S)		
Given Name (first and middle [if any])	Family or Surname	Residence (City and either State or Foreign Country)

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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))–INDEPENDENT INVENTOR

Docket Number (Optional)

Applicant, Patentee, or Identifier: ROGER JAMES SMITH

Application or Patent No.:

Filed or Issued:

Title: A PULSED POLARIMETER

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☐ the specification filed herewith with title as listed above.
- ☒ the application identified above.
- ☐ the patent identified above.

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Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.
- ☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

ROGER J. SMITH		
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Roger J. Smith		
Signature of Inventor	Signature of inventor	Signature of inventor
Nov 24, 98		
Date	Date	Date

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60110643.120198

A Pulsed Polarimeter

This invention relates to a new measurement method which I call 'pulsed polarimetry' and the instrument to perform this measurement, 'a pulsed polarimeter'. Pulsed polarimetry is the sensing of the polarisation state of back scattered light from a propagating light pulse, propagating within some material medium. The sensed polarisation is directly related to the magnetic or electic field at the position of the pulse in the medium.

The measurement of magnetic and electric fields in hostile environments, or remotely such as in a magnetically confined plasmas is difficult. A pulsed polarimeter is a novel tool for making such measurements.

According to the present invention, a pulsed polarimeter makes a spatially and temporally localised measurement of the electromagnetic field, either the local magnetic field or the local electric field, within the material medium under study or in an optic fibre embedded in the medium under study. The method consists of a polarised light source producing a pulse of light of the required spatial dimension for the measurement, a propagation medium that is sensitive to the field being measured, either a magneto-optically or electro-optically active medium, and an ellipsometer detection system that measures the polarisation state of the return radiation that is back scattered from the propagating light pulse. The measurement is directly related to the field at the position of the propagating light pulse in the medium.

A specific embodiment of the invention will now be described by way of examples with reference to the accompanying drawings in which:

Figure 1 shows pulsed polarimetry applied to the measurement of the internal magnetic field in a magnetically confined plasma. The pulsed polarimeter exploits the Faraday rotation effect of the plasma to directly measure the magnetic field along the line of sight at the position of the pulse. A continuous measurement of the polarisation of the back scattered radiation yields a continuous measurement of the magnetic field with a spatial resolution set by the length of the light pulse. This is a novel method of measuring the internal magnetic field in a magnetised plasma.

Figure 2 shows pulsed polarimetry applied to the measurement of the magnetic field outside of the vacuum chamber. In this case, a magneto-optically active optic fibre is used as the propagation medium and the Faraday rotation effect is again exploited to measure the magnetic field within the fibre along the direction of the fibre to a spatial resolution of the length of the propagating pulse. This is the same magnetic field that would be present without the fibre. A continuous measurement of the polarisation of the back scattered radiation yields a continuous measurement of the magnetic field with a spatial resolution set by the length of the light pulse. This enlarges the scope of pulsed polarimetry described in Figure 1 to any volume of space accessible to an optic fibre.

Claims

1 A novel experimental method is proposed which I call 'pulsed polarimetry', the sensing of the polarisation state of the back scattered light from a propagating light pulse, propagating within some material medium. The sensed polarisation is directly related to the magnetic or electric field at the position of the light pulse in the medium.

A pulsed polarimeter makes a spatially and temporally localised measurement of the electromagnetic field, either the local magnetic field or the local electric field, within a material medium under study or in an optic fibre embedded in the medium under study. The method consists of a polarised light source producing a pulse of light of the required spatial dimension for the measurement, a propagation medium that is sensitive to the field being measured, either a magneto-optically or electro-optically active medium, and an ellipsometer detection system that measures the polarisation state of the return radiation that is back scattered from the propagating light pulse. The measurement is directly related to the field at the position of the propagating light pulse in the medium.

2 The scattering process, as in claim 1, producing the return light can be aided by doping the electro- or magneto-optically active medium with scattering material or introducing reflection layers or material discontinuities.

3 The method, as in above claims, can potentially probe objects of the physical size of the wavelength of the light used, submicron dimensions, both in the longitudinal and transverse dimensions.

4 Coherent light can be used, as in claims 1 and 2, to sense the phase of the return light using interferometric detection.

5 Complex frequency and amplitude modulation techniques can be used, as in claims 1,2 and 4, in the production of the light pulse, such as a frequency chirped pulse, and the detection of the return radiation, to aid in the study of the local fields of the medium.

6 Other active properties of optic fibres can be exploited for measurement, as in claims 1,2,4 and 5. For example, strain induced polarisation changes for measuring local pressure or stress, temperature induced changes to the scattering amplitude or elongation of the fibre between reflecting layers, etc. All of which, generalise the method of making a localised measurement of the surrounding medium to the optic fibre using the return radiation from a propagating light pulse in the fibre.

7 The method, pulsed polarimetry, as described in above claims, allows the remote sensing of electromagnetic fields at higher bandwidths and smaller spatial dimensions than electrical probes and without the use of conducting wires. A pulsed polarimeter instrument based on optic fibres can be used in any medium that can tolerate the introduction of the fibre even living tissue.

Abstract

A Pulsed Polarimeter

Pulsed polarimetry is the sensing of the polarisation state of back scattered light from a propagating light pulse, propagating within some material medium. The sensed polarisation is directly related to the magnetic or electric field at the position of the propagating pulse in the medium. A pulsed polarimeter, performing pulsed polarimetry, consists of a polarised light source producing a pulse of light of the required spatial dimension for the measurement, a propagation medium that is sensitive to the field being measured, either a magneto-optically or electro-optically active medium, and an ellipsometer detection system that measures the polarisation state of the return radiation that is back scattered from the propagating light pulse. The use of fibre optics as the propagation medium enlarges the scope of pulsed polarimetry to any medium under study that tolerates the introduction of an optic fibre and to more general measurements, such as local stress, temperature and pressure, for example. Potentially, volumes with sub-micron dimensions can be probed.

A Pulsed Polarimeter Used to Measure the Internal Magnetic Field Along the Line of Sight Using the Faraday Rotation Effect Produced by a Magnetically Confined Plasma

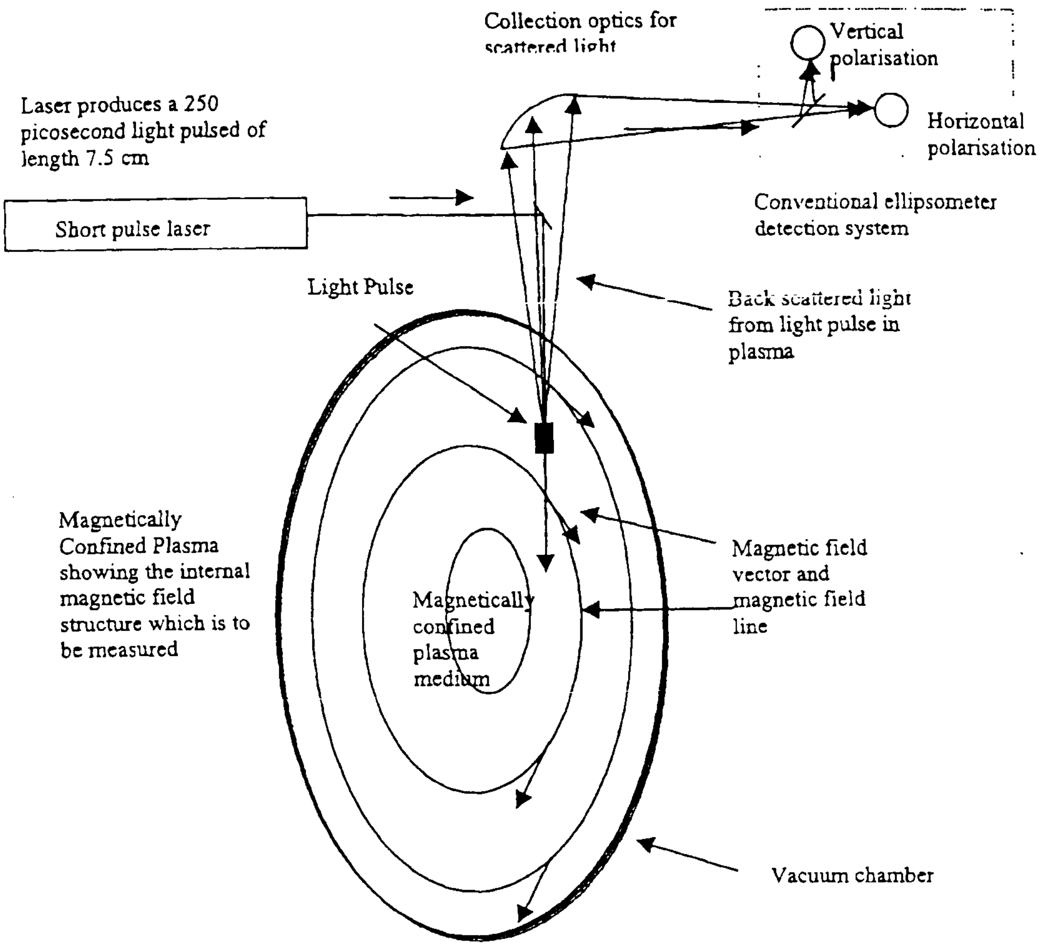

Figure 1

A Pulsed Polarimeter Used to Measure the External Magnetic Field Outside the Vacuum Chamber of a Magnetically Confined Plasma Using a Magneto-optic Active Optic Fibre as the Propagation Medium

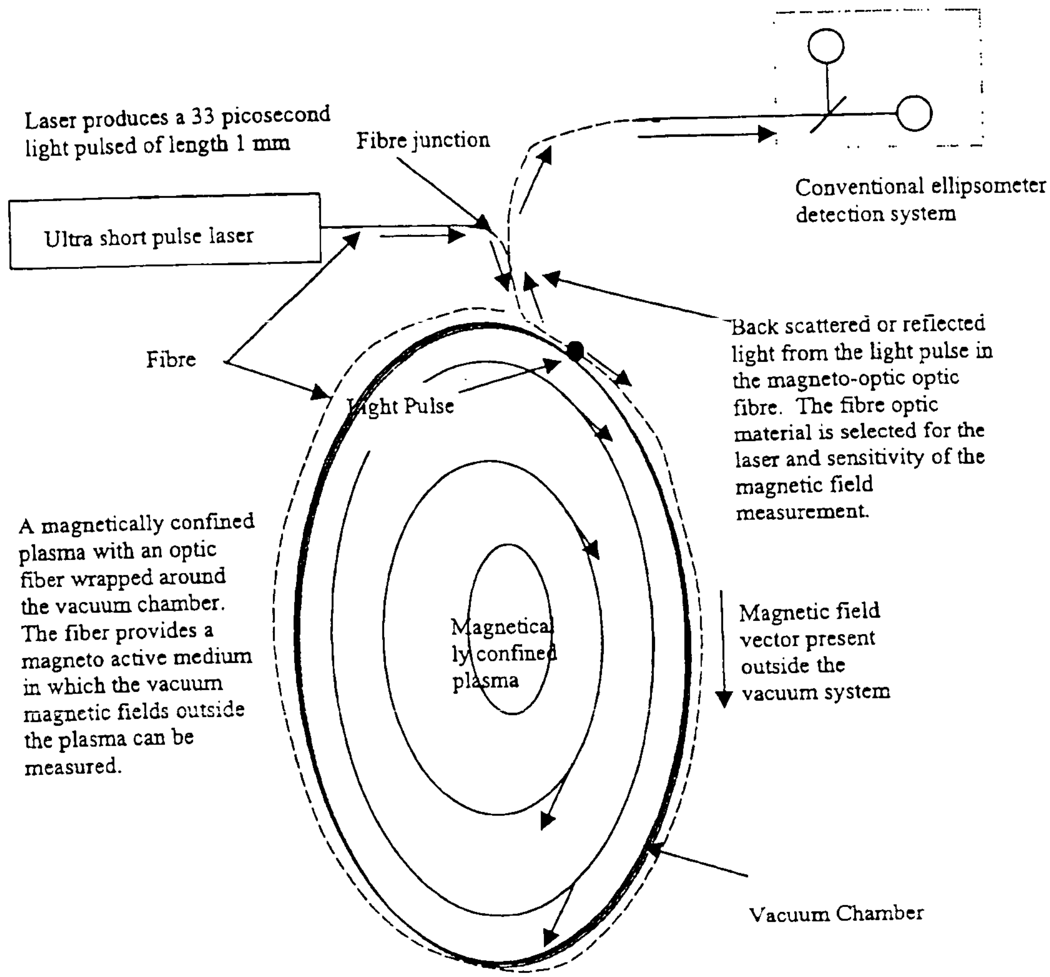

Figure 2

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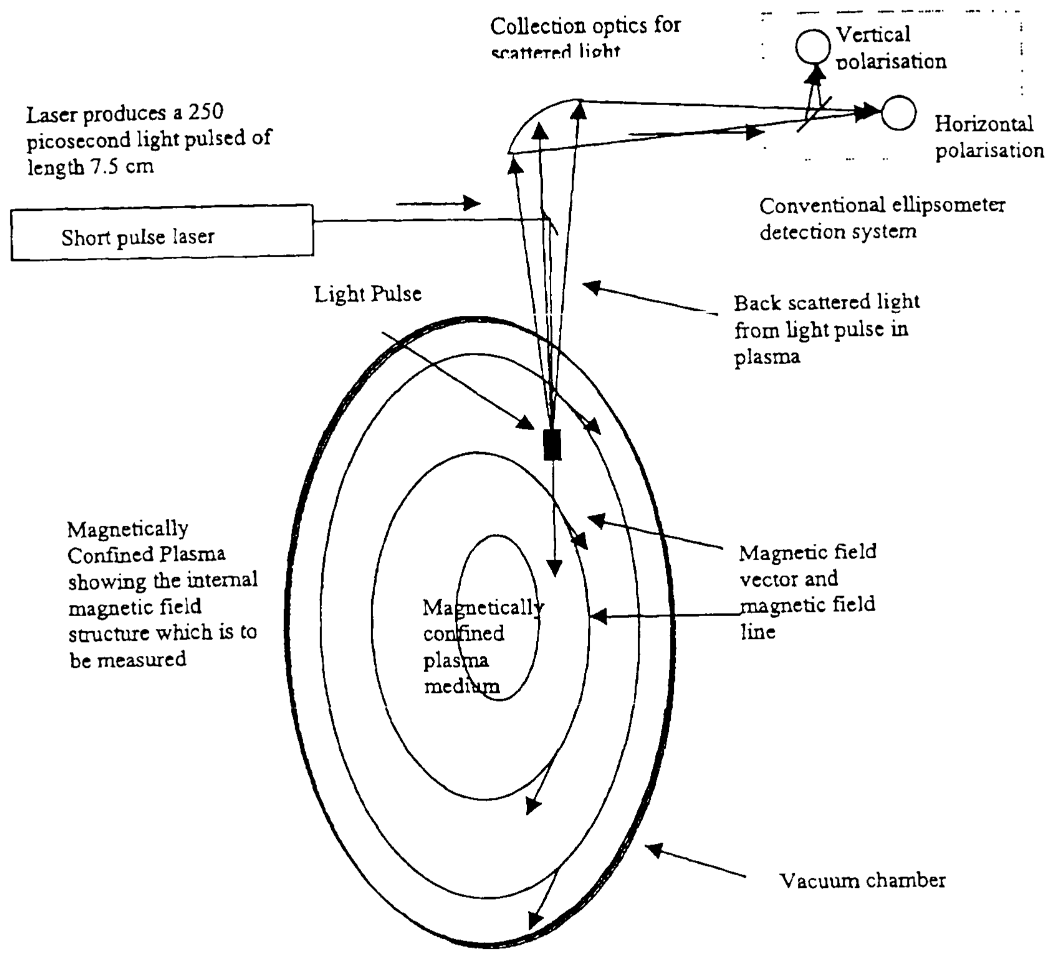

Figure 1

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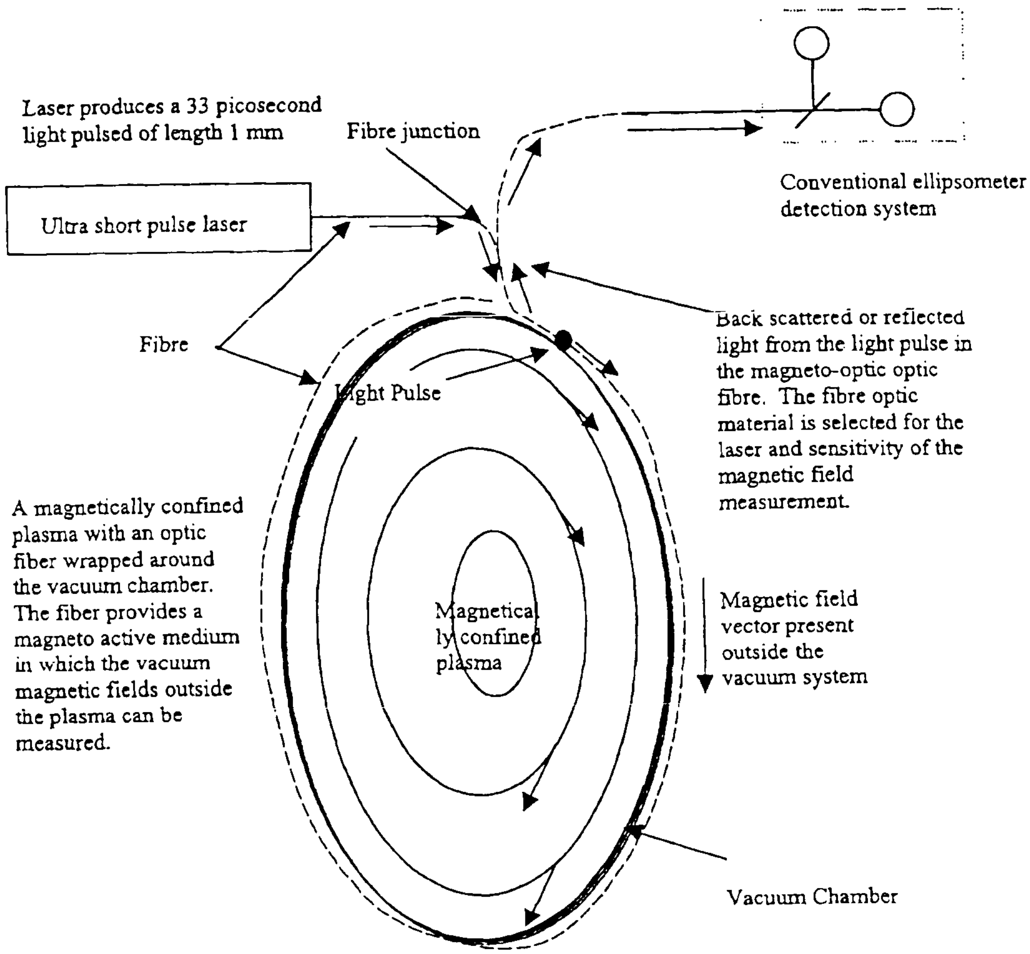

Figure 2

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